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IN NOVEMBER 2016, the Environment Protection Agency (EPA) released the final rule for biofuel volumes under the Renewable Fuel Standard (RFS) for 2017. The total renewable fuel volume requirement for 2017 is 19.28 billion gallons, up from 18.11 billion gallons in 2016. Of the total renewable fuel volume, 15 billion gallons may be met with conventional biofuel, establishing the implied mandate for ethanol. This ethanol mandate was 14.5 billion gallons in 2016. Much has been written about the blend wall and how difficult it is for ethanol consumption to exceed the volume that can easily be blended in regular gasoline (E10), which contains no more than 10 percent ethanol. There are many ways to break the blend wall, but it appears that greater sales of gasoline blends that contain more than 10 percent ethanol will play a major role. In two recent studies, we examine the demand for E85, which contains between 70 and 75 percent ethanol.

Past E85 sales volumes have been relatively small for three main reasons. First, while E10 is offered at virtually all of the 110,000 fuel stations in the United States, E85 is offered at less than 3,000 fuel stations. A recent grant program of the United States Department of Agriculture (USDA) aims at increasing the number of stations that offer high-ethanol blends of gasoline. Thus, the number of fuel stations that offer E85 is expected to increase in the next year and become less of a bottleneck in the expansion of E85 sales.

The second reason sales volumes have been small is that E85 can only be used by flexible-fuel vehicles (FFVs). The number of FFVs in the United States is currently less than 10 percent but growing steadily.

We found that 13 percent of motorists who fueled with E10 did not know their vehicle was an FFV that could use E85. Among those who knew their vehicle was an FFV, 62 percent had never fueled with E85, and 26 percent did not know that the fuel station where they were interviewed offered E85.

The third reason E85 sales volumes have been relatively small is that the majority of motorists who are able to both use and access E85 have not been fueling with it. Our research focused on US motorists with FFVs (flex motorists), their attitudes toward E85, and why they choose the fuel they choose. We conducted a survey of flex motorists at fuel stations offering E85 in Arkansas, California, Colorado, Iowa, and Oklahoma. The retail model was slightly different at the stations we visited in California, and there were other confounding factors. In the interest of brevity, we omit the California data from the following summary of our findings.

We approached flex motorists at fuel stations immediately after they began fueling with either E10 or E85, and we asked a few questions to assess their knowledge and preferences. Ignorance about E85 appears to be one of the reasons why more motorists do not fuel with E85. Table 1 shows survey responses from motorists who fueled with E10. We found that 13 percent of motorists who fueled with E10 did not know their vehicle was an FFV that could use E85. Among those who knew their vehicle was an FFV, 62 percent had never fueled with E85, and 26 percent did not know that the fuel station where they were interviewed offered E85.

Table 2 summarizes responses to opinion questions about which fuel is better, either ethanol (E85) or gasoline (E10). First, observe that many motorists could not correctly answer several of our questions, signaling lack of information about the two fuels, especially among motorists who selected E10. As expected, motorists who fueled with E85 tended to have a better opinion of ethanol than those who fueled with E10. Whether ethanol is actually better than gasoline for the environment, the economy, and national security is not established with certainty, and responses to these questions may reflect flex motorists' sources of information. However, for the questions about which fuel is better for their engine and which fuel yields the most miles per gallon, the facts are established. Car manufacturers are clear that E10 and E85 are equally as good for the engine, but small proportions of E10 and E85 flex motorists responded that there is no difference. It is also a fact that gasoline yields more miles per gallon than ethanol. Of the E10 motorists, 69 percent answered correctly, and 61 percent of the E85 motorists answered correctly.

We find that prices for E10 and E85 are the most important factors in flex motorists' decisions to fuel with E10 or

Table 1. Responses from Flex Motorists who Fueled with E10

	Yes	No /Don't know	Total
Is your vehicle flex-fuel capable of using E85?	368 (87%)	56 (13%)	424
Have you ever fueled with E85?	140 (38%)	228 (62%)	368
Did you know this station sells E85?	273 (74%)	95 (26%)	368

Table 2. Responses to Fuel Opinion Questions

	Ethanol	Gasoline	No difference	Don't know
Flex motorists who fueled with E10 (424 responses)				
Which fuel is better for the environment?	63%	11%	15%	12%
Which fuel is better for your engine?	21%	51%	15%	13%
Which fuel is better for the economy?	49%	28%	10%	12%
Which fuel is better for national security?	38%	22%	18%	22%
Which fuel yields more miles per gallon?	11%	69%	5%	15%
Flex motorists who fueled with E85 (226 responses)				
Which fuel is better for the environment?	72%	4%	16%	9%
Which fuel is better for your engine?	40%	31%	16%	13%
Which fuel is better for the economy?	73%	12%	9%	6%
Which fuel is better for national security?	55%	14%	11%	20%
Which fuel yields more miles per gallon?	21%	61%	5%	12%

E85. If flex motorists only cared about the cost per mile driven, they would fuel with E85 when its price is less than 75 percent of the price of E10. However, other considerations enter into a motorist's decision, including the opinions discussed above. We find, after controlling for opinions, that the average flex motorist switches from E10 to E85 when the price of E85 is between 53 and 63 percent of the price of E10. This means that the average flex motorist discounts E85 by 20–25 percent more than the 75-percent price ratio that corresponds to cost-per-mile equivalency. With the price of E10 currently at about $2.40 per gallon, E85 would need to sell at less than $1.39 per gallon for a majority of flex motorists to fuel with E85.

Our studies show that motorists are still quite uneducated about high-ethanol gasoline blends such as E85 and that motorists considerably discount E85 compared to E10. Sales of E85 will be important for meeting the 2017 renewable fuel volume requirement. Increasing sales of E85 enough for compliance will require significantly lowering the E85 price and better educating flex motorists. ■

ADVANCING SUSTAINABILITY
College of Agriculture & Life Sciences

CALS Sustainability Symposium
April 13, 2017, Scheman Building, Iowa State University, Ames, Iowa

The day's activities at Scheman Building will begin at 9 a.m. with a presentation by Catherine Woteki, former under secretary of the USDA's Research, Education and Economics mission area and its chief scientist, about sustainability efforts at the federal level.

Catherine Woteki, a past CALS dean, will speak about the federal government's sustainability efforts. There also will be a poster session and panel discussions about sustainability in the college.

The symposium is being organized by the CALS Sustainability Task Force. The task force was formed last year to begin a college-wide dialogue on sustainability to consider how the college can focus and more fully engage in sustainability across our research, education and extension and outreach missions.

You can find out more about its work at the CALS Sustainability Task Force website.

www.card.iastate.edu/sustainability